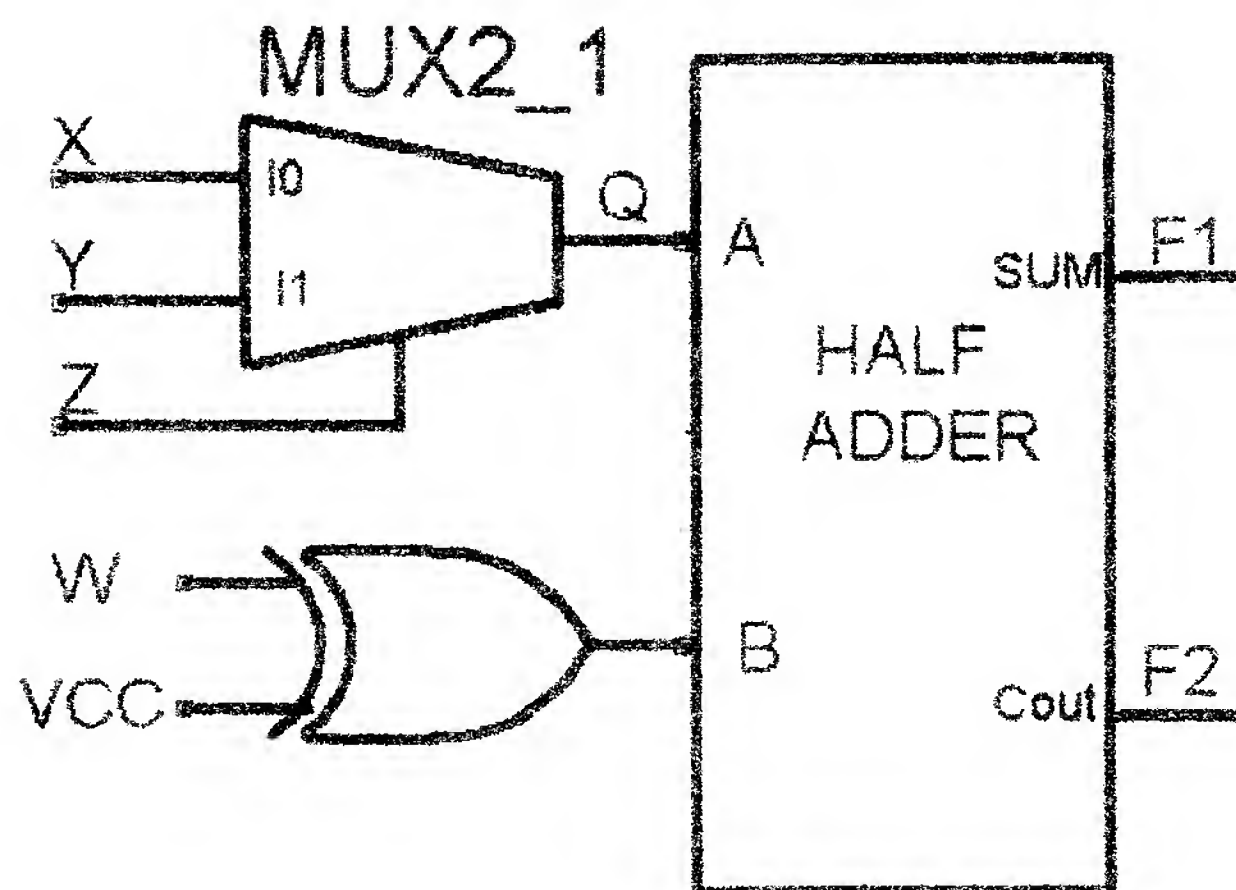


Question 1 (25 points)

Redesign the circuit shown in figure by using only 2-input NAND gates.

**Question2 (25 point)**

Design by using 4-bit adder ICs and comparator IC, a combinational circuit which has four input variables and only one output, the inputs represents a 4-bit number, the function of the circuit is to multiply by three any input number, then check for the multiplication result, the output of the circuit is equal to one only if the input number is five.

Question 3 (25 point)

A combinational circuit has 4 input $X_3 X_2 X_1 X_0$ and 4 output $Y_3 Y_2 Y_1 Y_0$. The outputs generate the 2's complement of the binary inputs. Design the circuit by using 3 to 8 decoders and NAND extra gates.

Question 4 (25 points)

a) Implement the following Boolean functions using a 4-to-1 Mux and any necessary gates:

$$F(A,B,C,D) = \prod (1,3,4,6,7,8,9,10,11,15)$$

b) Show how to make an 8-to-1 Mux using 4-to-1 Mux and one 2-to-1 MUX.